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Thermodynamics of superconducting quantum metamaterials PIERRE-LUC DALLAIRE-DEMERS, FRANK WILHELM-MAUCH, Universität des Saarlandes — Left-handed matematerials are capacitively coupled layers of inductive pieces of conductors. These systems are well studied in the context of microwave metamaterials but their full quantum description or their embedding in highly correlated materials like superconductors are still an open problem. Notably, they are known to have a Van Hove singularity in the density of states at low energy and high pseudo-momentum that could effectively couple and condense Cooper pairs. The goal of this research is to analyze the thermodynamical properties of the order parameter of stacked layers of superconductors with a small repulsive Coulomb interaction. A 3D toy model of such a material is mapped to a Fermi-Hubbard lattice. The temperature dependent anomalous correlation functions are computed variationally from a self-energy functional of a small cluster where inter-cluster tunneling is treated perturbatively. The effect of the repulsive interaction on the Cooper pairs binding can then be seen from the momentum distribution of the condensation amplitude. Such a material could potentially be realized with optical lattices or nanoscaled superconductors.

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